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ABSTRACT

The work of "A Better Chance," a Boston (Massachusetts)-based national talent search and referral agency is described in this document. The agency seeks out academically able minority students and places them in private preparatory schools or select public secondary schools. The program involves identifying and recruiting students, matching students with schools, and providing student support after placement. Examination of the results of two studies of "A Better Chance" graduates found that the program: (1) provided opportunities and experiences students needed to maximize their abilities, and (2) determined the predictive validity of various standardized tests. Recent program initiatives and plans for future program development are noted. Maxine Bleich, in a reaction to the paper, describes a program sponsored by the Josiah Macy, Jr. Foundation to increase the number of minority students being academically prepared for medical school. Belvin Williams then offers comments on the use of standardized tests and the importance of social context in student selection. (JDD)

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BETTER MEASURES: DEVELOPING MORE MINORITY MATHEMATICIANS AND SCIENTISTS

Judith Berry Griffin

The relatively small number of minorities pursuing careers in science, mathematics, engineering and other "high-tech" fields has been well-documented over many years. This continued (and increasing) underrepresentation is of great concern to educational practitioners for several reasons. We at A Better Chance, Inc. (ABC) view competence in mathematics and science as controlling current and, more importantly, future career opportunities. We recognize that increased career opportunities will help America remain competitive in an increasingly internationally-oriented society where technological skill is the major currency. And we acknowledge and understand the population changes projected to begin their impact in the United States within the next ten years--changes which will bring a rapid and significant increase in the numbers of minority workers.

These facts are even more sobering when viewed against a national backdrop. Here we see increasingly common incidents of racial violence. There we find our inner cities, with distressed schools and inadequate housing, barely containing a burgeoning underclass without jobs, without money, without hope for a better future. And over all has settled a treacherous miasma of personal and organizational greed and selfishness, making attention to equity issues of disinterest to many and appropriate remediation difficult to shape. For educational practitioners, among others, concern has given way to anxiety that America is on the verge of becoming a second-rate, ungovernable society.

Under these grim conditions, new and innovative methods of identifying, recruiting and adequately educating all minority young people, and stimulating interest in science-mathematics endeavors, must be sought and supported.

The work of A Better Chance has long been based on the hypothesis that there exists a pool of broadly talented minority students whose abilities are best identified by criteria in addition to the quantitative measures traditionally employed for student assessment. In the process of confirming this hypothesis, we have found that certain factors have a probable positive effect in encouraging a good number of these students to select courses of study (and eventually careers) related to mathematics and science. This paper will document the validity of these observations.

Many reasons have been promulgated for the failure of minorities to pursue math-science careers in greater numbers. Among them have been: socioeconomic background; academic background; student adjustment and integration into campus life; institutional characteristics; mentors; and cultural orientation toward competition and success.¹ Also noted have been inadequate financial aid; low expectations for minority student achievement; and the lack of well-organized and aggressive programs for recruitment, selection and retention.²

During the past 15 years a number of special programs have been developed to stimulate and support minority student interest in math-science education. These programs have been particularly visible in the field of engineering, from which such efforts were first mounted. Although it is difficult to adequately examine their success, since information is limited and effective methods of assessment and comparisons have not been developed, some measurable results have

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been produced. We know, for example, that the number of minority graduates from these programs increased tenfold between 1971 and 1986,³ and the number of blacks among all students pursuing engineering degrees rose from 4.5 percent to 7.5 percent in one five year span (1973 to 1978)⁴. By 1985, blacks were earning nearly three times as many baccalaureate degrees in engineering as they had ten years earlier.⁵

However, these modest gains are overwhelmed by the more pessimistic figures describing actual movement of minorities up the science-mathematics academic ladder and into the working world. The 1980 statistics produced by the National Science Foundation show that blacks remained greatly underrepresented in the science-engineering work force, constituting 1.6 percent of that group, although they represented 7 percent of all professional and related workers (NSF, 1982). Moreover, graduate enrollment figures show that only about half as many blacks as whites progress from baccalaureate to master's level graduate studies in these fields (similar figures apply to Hispanic and Native American students). In 1985, only 64 American Blacks earned doctorates in physical science, mathematical or computer science, or engineering, as compared to 118 American Hispanics, 522 Asian Americans, and 3,031 foreign students.⁶ And the numbers of black students enrolling in and graduating from colleges and universities has actually decreased over the past several years.

The available evidence supports two conclusions. First, despite the small gains made by minority students in entering mathematics-science-engineering fields of study, they continue to be severely and increasingly underrepresented in these areas. Second, retention of minority students in these fields becomes even more problematic as these students continue through the education pipeline. Attempts to ameliorate the first condition, then, must be strongly supported by an examination and understanding of the probable causes of the second.

The opportunity to study this problem in a unique way has recently become possible through the documentation of the efforts of A Better Chance, Inc. (ABC). For 25 years this Boston-based national talent search and referral agency has been scouting the nation's inner cities, seeking out academically able minority students and placing them in some of the country's most selective and prestigious independent preparatory schools, and a few select public secondary schools. ABC's alumni (those graduating from secondary school between 1966 and 1987) and its enrolled students (those currently attending grades 7 through 12) together number some 74,000. The alumni group, most of whose academic and social environments have been dramatically altered by their association with ABC, is highly mobile, as its members pursue many differing career and educational options.

The pilot program that was to become A Better Chance came into existence in 1963 as a partnership between Dartmouth College and a group composed of 23 heads of the country's leading independent boarding schools. Officials at Dartmouth were concerned with increasing the college's enrollment of the college's black students. They proposed to do so by means of "Project ABC," through which high school students with high academic potential would be identified and offered a summer of intensive academic work, thus paving the way for college entrance and easing what would undoubtedly be a difficult academic and social transition. The group of school heads had meanwhile initiated a similar effort to identify and

recruit black students through a project called the "Independent Schools Talent Search" (ISTS). Joining forces, projects ABC and ISTS worked out a plan to enroll 50 boys in the cooperating prep schools, contingent upon their successful completion of Project ABC on the Dartmouth campus. ABC and ISTS eventually merged to become A Better Chance, Inc.

Funding for this joint venture was initially obtained both from private sources and the Federal government's anti-poverty program. A simply worded mission statement was adopted: to "substantially increase the number of well-educated minority people who can assume positions of responsibility and leadership in American society." Through the years this goal has remained essentially constant, although varying methods of effecting it have been employed by ABC.

Significant changes took place as the program evolved. Girls' boarding schools were quickly added to the client list, then day schools. In the late 1960's "Public School Programs" (PSPs) were introduced. Funded and organized by volunteers who live in the mostly suburban communities which house the programs, the PSPs operate on the boarding school concept. ABC students live with Resident Directors in a community-leased or community-purchased "ABC house" and are thereby eligible to attend the local high school. The students are supported by local volunteer "host families." Among ABC's present population 161 member schools are 23 PSPs, enrolling from six to twelve students each.

Since major student recruitment activity takes place in some of the nation's most distressed inner city neighborhoods, e.g., Harlem, the South Bronx, and Brooklyn, New York, and comparable neighborhoods in such cities as Chicago, Detroit, Philadelphia, Newark, Los Angeles and Atlanta), the majority of ABC students require full-need scholarships at the accepting schools. Partial scholarship assistance for each student was available until the early 1980's through certain federally funded programs. However, the last of these grants was exhausted in 1980. Since then, funding for ABC's activities has been secured through private sources--gifts and grants from corporations, foundations, and individuals (including alumni). Member schools absorb the necessary tuition costs for the students.

The basic activity of A Better Chance is identifying, recruiting, matching and referring mostly ninth and tenth grade students to its school clientele, and providing limited student support services. ABC's work is made possible by an energetic and enthusiastic network of some 3,000 volunteers across the country, who, among other activities, distribute 15,000 informational application packets each fall.

For students, the selection process begins with the submission of a completed application, which requests family and personal information, official school transcripts, and recommendations from "sending" teachers, guidance counselors or principals. The process also requires applicants to write essays, to be interviewed, and to take the Secondary School Admissions Test (SSAT).

Of the applications returned and initially processed by the ABC staff, approximately 1,300 are selected for close scrutiny. These 1,300 are eventually reduced to approximately 700 "active" applicants, who form the pool from which approximately 325 students will finally win placement.

At the heart of the process is the work of the ABC "referral committee", which considers all applicant information, member school characteristics, successes of previous students and other factors. The committee then carefully selects two or more schools at which it believes each applicant may find a comfortable "fit". Student application materials are forwarded to the selected schools, whose admission officials decide whether or not to admit each applicant. Applicants not admitted may or may not be referred by ABC to additional schools.

Once students matriculate, specific student support is offered through on-going direct student contact and through contact with school-assigned "ABC Coordinators" at each member independent institution and with PSP Resident Directors. Students are more generally supported by means of such activities as elective summer enrichment programs, and a competitive program of awards for academic excellence, for leadership, and for perseverance. College counseling is provided for juniors and seniors. Attendance at a one or two day pre-matriculation program is required, and individual counsel with students, parents and school faculty can also be provided as needed.

A Better Chance has maintained some contact with its alumni through the years, but has increasingly come to recognize the need to develop and maintain a data base of information on its graduates and their post-high school progress. Because detailed information on this type of population is not available elsewhere, such a data base would be highly valuable in addressing, among other questions, the concerns ABC and many other groups have had about the relatively small numbers of minorities entering science, mathematics and the technical fields in general. These dual concerns were combined in a proposal which resulted in a grant from the Ford Foundation to survey ABC alumni in order to: 1) improve ABC's data base by updating its alumni files, and 2) gain information useful in determining factors which might contribute to enlarging the pool of minority group men and women who choose to enter mathematics and science-related careers.

The resulting extensive study of ABC alumni was conducted during 1982 and 1983 by Sylvia T. Johnson, Professor of Educational Research Methodology and Statistics at Howard University, with the assistance of Research Associate Sukai E. Prom-Jackson. Its primary objective was "to investigate the process of career choice among ABC graduates, with particular emphasis on the factors affecting the choice or rejection of careers in science and mathematics."⁷

In 1987 a second, less extensive study of ABC graduates was also conducted by Dr. Johnson, this time with the assistance of Michael E. Reed, who was at the time Director of Programs at A Better Chance. With funding provided by the Andrew Mellon Foundation, this study undertook the investigation of "the adequacy of equitably predicting the achievement of ABC-identified students through the use of currently standard testing technology."⁸

It is our belief that an examination of the results of both of these studies can help illuminate the problems associated with the identification of talented minority youth and their education and retention in math-science fields. We additionally believe that, while further documentation is certainly appropriate, these studies' findings to date clearly commend a specific course of action.

**The Ford Study:
Science and Mathematics Career Choice
Among Talented Minority Graduates of A Better Chance, Inc.**

Background and Rationale

According to Dr. Johnson:

Many studies have documented the fact that relatively few Black, Hispanic and American Indian students take advanced high school courses in Mathematics and science. Most then conclude that this is a major reason for the low proportions of these groups found both among college majors in mathematics and science, and among related professional fields.⁹

She further states:

What causes the low level of participation in advanced high school courses in mathematics among Black and Hispanic youth? An extensive set of studies documents the roles of several factors, including aptitude, achievement, personal interests, career interests and aspirations, perceived utility of mathematics to career interests, sufficiency of career information, attitudes toward science and mathematics, the high school curriculum and graduation requirements, the nature of guidance and counseling services, family support, social support, and the availability of role models in science and mathematics-related fields . . . Missing from these studies is an investigation of college major and career choice among minority students with strong general academic preparation in mathematics, science, English and other areas.¹⁰

The opportunity, then, to investigate the incidence of these career choices among ABC students, who have both taken these advanced courses and have been well prepared to do so, is particularly inviting.

Methodology

To investigate the process of career choice it was necessary to gather information regarding these young people in a variety of areas. The areas selected included high school and college experience, family background, personality dynamics and work orientation, as well as specific information on current and planned vocational choices at several stages, and the reasons for these choices.

A lengthy and detailed survey instrument was constructed to provide basic descriptive information on the population to be studied and was mailed to all ABC graduates with known addresses. Follow-up communications were also utilized over several weeks. The 813 respondents who completed surveys (25 percent of the number mailed) constituted the sample population. Since hundreds of surveys proved undeliverable the return rate is assumed to approximate 40 percent of the material actually received by alumni.

The sample group turned out to be 57 percent male and 43 percent female; 76 percent Black, 11 percent Hispanic, 3 percent Native American, 3 percent Asian, and 7 percent unidentified or "other" races. It included graduates spread across all ABC's years of operation.

The survey instrument, which was completed anonymously, examined high school and college characteristics, services, sources of funds, student experiences and performance, self-perceived ability, family background, experiences and values, personal values, reasons for career choice, job-related values and job satisfaction, and personality dynamics and work orientation. These factors were examined to determine their relationship to two primary variables:

- Choice of advanced science/mathematics courses in high school
- Choice of a science/mathematics career.

Findings

The findings revealed that was the best predictors of the taking of advanced science and mathematics courses in high school were the following:

- The self-perception of ability in science and mathematics
- The perception of the high school mathematics curriculum
- The identification of a high school mathematics or science teacher as the most influential person in one's school experience
- The academic atmosphere of the high school

Among graduates who had taken advanced science and mathematics in high school, the primary reasons given were the following:

- Interest
- The challenge of the subject
- Perceived ability

Graduates who had not taken advanced science and mathematics reported that they were more interested in social sciences, but they did not, in general, indicate a lack of interest in science or mathematics.

When the choice of a career in science or mathematics was the criterion, 34 significant predictors were identified. The major predictors were as followed:

- Self-perception of ability in science and mathematics
- Enrollment in advanced mathematics courses in high school
- The influence of a science or mathematics teacher

- The perception of the high school science and mathematics curriculum

Graduates who had high self-perceived ability in social sciences tended not to choose science-mathematics careers.

Personal values, personality characteristics and work orientation did not contribute importantly to the prediction of the selection of a career in mathematics and science. While those choosing such careers did indicate involvement as community leaders, there was some tendency for those choosing careers in other areas to be even more involved.

Parental values were also related to career selection. Among both sexes, graduates whose mothers believed strongly in the development of individual talents without linking them to sex role, and whose fathers or mothers encouraged them to study mathematics and science, tended to choose such careers.¹¹

In other words, the pursuit of, and even success in, mathematics and science courses in high school is apparently not enough to ensure that minority students will select math-science careers. More is needed: excellent and dedicated teachers, high quality science curricula, a strong academic atmosphere, parental encouragement, self-confidence, and the availability of appropriate courses.

Another interesting finding was that, in high school, top grades in mathematics and science courses more closely correlated with top grades in non-mathematics and science than with any other single variable. The report specifically noted that for many ABC students, the choice of a career is made very difficult by their competencies in many academic areas. This argues against the notion that minority students fail to pursue math-science careers because they are not academically able. On the contrary, ABC students possess such high ability in all areas that science and mathematics careers must compete with other options.

The study's most significant finding, however, was that ABC students pursue mathematics and science careers at a far greater rate than do other minority students. *The proportion of ABC graduates all choosing such careers was the same as the students choosing mathematics-science careers nationally.* This finding was true for the total ABC graduate sample, and for the sample of black students considered separately. Thus, the study concludes that given a high school background that allows the choice of a variety of majors, ABC alumni are as likely to choose a mathematics or science career as are non-minority students. The intervention of the ABC experience in the lives of these students, then, has made a significant and positive difference in the selection of a math-science career.

Conclusion

Negative differences for the minority population, as compared with the majority population, are standard in indices of academic performance such as high school grades, standardized test scores, proportions of students graduating from high schools and proportions enrolling in college. But for the sizeable number of students ABC has been able to reach, a critical area of endeavor has been equalized. In a remarkably brief period of time, it has been possible for ABC's

minority students to build the personal enablers for choosing careers in mathematics and science, if they care to, to the same degree as non-minority students.

A Better Chance has made this difference by providing the opportunities and experiences that students apparently need to maximize their abilities. Among the most important experiences that students apparently need are self-perceived ability, enrollment in advanced courses, an influential math-science teacher, and a positive perception of the math-science curriculum.

The Mellon Study: Significant Predictive Factors of the Academic Achievement of the 1986 Class of Graduates of A Better Chance, Inc.

Background and Rationale

The ABC application-selection-referral process requires that each of its applicants take the SSAT. Reports of the scores obtained from it and from other standardized tests become a part of the student record maintained by ABC. However, ABC staff have long believed that traditional admissions criteria may not have the same predictive value for ABC-referred students as for others in a typical independent school applicant pool. Specifically, ABC staff involved with matching and referring ABC applicants to member schools have been concerned that ABC applicants--particularly those with low standardized test scores--may be assumed by member school admissions committees to be unprepared to take up difficult academic challenges, when in fact they are not.

In the experience of the ABC staff, ABC applicants generally do not deviate from the findings of national surveys which report that Black, Hispanic and Native American students achieve relatively low scores on standardized tests. This is a general finding and this group was no exception. However, it is also our experience that most of these students, having matriculated at ABC member schools, do well at these schools.

ABC staff developed the idea for the Mellon study specifically to provide a stronger rationale for urging admission of ABC applicants to those of its member schools where high standardized test scores traditionally have been viewed as prerequisite to academic success and, therefore, to admission.

Methodology

The sample population was 239 ABC students graduating from ABC member schools in 1986. Of this group, 51.9 percent were male and 48.1 percent were female; 65.9 percent were Black, 21.8 percent were Hispanic, 9.2 percent were Asian, and 3.1 percent had other backgrounds. Fifty-five point one (55.1) percent of the students entered ABC schools in the ninth grade, 39.1 percent entered at the tenth grade level and 5.8 percent were eleventh grade entrants.

Academically, the 1986 class of ABC-recommended students had performed quite well. Their first year mean grade point average was 2.8 (2.0 = C), with a

standard deviation of 1.24. Their second year mean grade point average was 2.7, with a standard deviation of .59. Although the second year mean is slightly lower, the much-decreased standard deviation shows that nearly all students were by that time performing just under a "B" average, and that about one third were achieving a "B" average or above.

In order to carry out the objective of correlating the academic performance of the 1986 graduating students to the specific techniques of assessment employed by the ABC staff upon these students' initial application to the program, it was necessary to review carefully the entire ABC application-selection-referral process.

In assessing the potential of our applicants, we acknowledge that the results of standardized tests such as the SSAT can impart important information about skills that are linked with academic success. However, we also strongly believe that a student's potential blossoms when he/she is offered an enhanced opportunity and challenged to accept it. Thus, the ABC selection process is specifically targeted toward seeking every possible reason, among a number of possible selection factors, to assume and uncover applicant ability and potential. ABC raters therefore do not place particular emphasis on standardized test scores, particularly when these scores are low. Instead, they look for such non-quantitative factors as leadership ability, broad academic and social interests, determination, creativity, tenacity, flexibility, and desire to excel. Records from sending schools are carefully examined, as are statements from parents, writing samples, and teacher comments.

Once students and schools are matched and referrals made, the ABC staff must work particularly hard to encourage acceptance of students viewed by admissions officials as only marginally acceptable. Far too often, in ABC's view, schools report that negative admission decisions have been made based on low applicant test scores. As it has been pointed out, frustration over these recurring comments, accumulated over years of work with member schools, which prompted ABC to seek the information which led to the study of its 1986 graduates.

The key variables employed by the staff in making referrals were identified, described and quantified as follows:

1. The ABC Performance Indicator (ABC-API), an index based on students' academic performance in their sending schools
2. The ABC Comprehensive Admissions Assessment (ABC-CAA), an overall rating given by ABC staff, based on all applicant information
3. The ABC Mathematics/Science Assessment, based on information from "sending" teachers, and counselors and/or principals
4. The ABC Language Assessment; also based on information from "sending" teachers, and counselors and/or principals, as well as student writing samples
5. The Secondary School Admissions Test (SSAT) Verbal score

6. The SSAT Quantitative score
7. The SSAT Total score

Findings

While students' first year performance could be predicted, the correlations were not high. Among the predictors studied, those with the highest correlations were the ABC Performance Indicator (ABC-API) and the ABC Mathematics/Science Assessment. The lowest correlations were obtained for SSAT scores.

By the end of the students' second year in their ABC schools the ABC-API and the ABC Comprehensive Admissions Assessment (ABC-CAA) had become the first and second major predictors of their performance there, followed by the ABC Language Assessment (third), the ABC Math/Science Assessment (fourth), and the SSAT Quantitative score (fifth).

It should be noted that the ABC-CAA (Comprehensive Admissions Assessment) is performed by people who have seen the SSAT scores, and the assessment is therefore, affected by these scores. In that sense, then, the assessment provides a "correction" to these standardized test scores, because ABC raters view them in the context of other information known about the student. The ABC-CAA, then, "corrects" some of the measurement and predictive error contained in the scores.

An additional intriguing finding was that, in general, students who left their ABC schools prior to graduation did not do so for academic reasons. The grade point average of these students was in fact higher than the grade point average of the students who stayed to graduation. This might indicate that first year students who are performing well may need as much additional encouragement as those performing at a lower level, even though this support may not seem as necessary.

Conclusion

Through the years there has been a great deal of controversy over standardized testing and what that testing does in fact measure. Particular, questions have been raised regarding the fairness of these tests for non-majority students, especially since many educational opportunities are awarded or denied on the basis of scores earned. In fact, questions about the appropriateness of using standardized test results as admissions criteria--for majority as well as minority students--has caused several colleges and universities to stop requiring them.

ABC has recently released the results of the Mellon study to appropriate faculty and staff at all of its member schools. In a Research Brief, dated February, 1988, ABC has strongly recommended to member school admissions officers "that SSAT scores not lead [them] to make negative admission decisions on students referred by ABC. Our data indicate that these scores have already served their most useful function by being considered, along with other criteria, to form ABC's Comprehensive Admissions Assessment. Considering them further, then, gives them credibility which is unwarranted for ABC-referred students."

We recognize that when a predictor such as the SSAT is used for selection, the spread of scores among the selected group will be smaller than its distribution in the total pool. Even so, we believe that the very low correlation of the SSAT with ABC student performance in ABC schools warranted the above recommendation.

Implications

There is good reason to assume that the groups of students studied were quite similar, since ABC's selection process has remained relatively unchanged. What, then, are the implications of these studies for the attempts we all must make to assure increased numbers of minority mathematicians, engineers, and scientists? Since 25 percent of ABC graduates eventually select math-science careers, and this is a highly desirable proportion, it is reasonable to begin to look at what is implied by reviewing the academic characteristics of these students. And, since student selection for math-science interest programs is traditionally based on academic preparedness (including standardized test scores), it is also reasonable to focus on the role that traditional selection criteria play in the group's selection.

A review of their characteristics reveals students who, among other attributes:

- Tended to do well in non-math-science courses as well as in mathematics-science courses
- Had taken advanced courses in other areas as well as math-science
- When asked to rate their abilities gave themselves higher ratings in "drive to achieve", "critical thinking" and "leadership" than in science and mathematics

The results of the Mellon study of the ABC class of 1986 also suggests that:

- These students may not have had outstanding standardized test scores upon admission to their ABC schools
- Those test scores may not have correlated highly with their subsequent academic propensities--among which was their propensity to select careers in mathematics and science. It would seem, then, that the pool of minority students capable of and potentially interested in math-science careers is broader than that which a focus on traditional measure of selection may indicate.

This conclusion is supported by the work of Edmund W. Gordon, Professor of Psychology and Afro-American Studies at Yale University. In a recent report to the field on the status of engineering education for minority precollegiate and college students. He states:

Since the number of academically able minority students graduating from high school each year is still relatively limited, it does not make sense that all of

our institutions compete for that same pool without first determining whether the pool can be expanded . . . Indeed, unless the pool can be expanded over a period of years, continued growth of minority representation in engineering and the related professions will be increasingly difficult to achieve.

We at ABC believe we are contributing to the expansion of this pool. At one level, our work is similar to that of others who use traditional indicators to identify talented students. However, we go beyond that. We select students whose test scores and certain other indicators may not be uniformly outstanding, but who exhibit confidence, tenacity, and determination to succeed. We believe we can determine these qualities by, among other things, carefully examining student records, and recommendations and other comments from teachers and counselors. We also place great emphasis on students' writing samples, and the overall quality of their applications, seeking evidence of thoughtfulness and creativity, clearly expressed and interesting ideas, and a general sense of direction.

In summary, ABC does not dispute the view that standardized test scores, academic achievement and stated interest in math-science as a field of study or a career can all be valid indicators of students' math-science aptitude. Rather, we emphasize our experience that other characteristics can be equally if not more important.

Research-Based Initiatives

The results of our research and our observations and experiences over the years have not only influenced our selection process, but have also affected program development. The resulting initiatives range from relatively minor readjustments in assessment emphasis to major program efforts. Four recent such initiatives have been:

- Establishment of the Damon Walsh Award
- Dissemination of research results
- Review and proposed revision of the ABC application form
- Collaboration with MIT

1. The newly-established Damon Walsh Award will be given to a first year ABC student demonstrating courage, tenacity and perseverance. It is hoped that by focusing attention on and rewarding these attributes, we may encourage students to further display them.

2. We are disseminating the results of our research to all those with responsibility for reviewing ABC student applications through the preparation and distribution of research briefs. Additionally, the results of the Mellon study were presented by Dr. Johnson and Mr. Reed at the Annual SSATB Conference in September, 1987. Finally, member schools and colleges have been notified of Dr. Johnson's availability to lecture on the technology of student assessment as illuminated by her research on ABC alumni.

3. A review of the ABC application form has been undertaken. Changes indicated will be reflected in next year's application, and Dr. Johnson will work with the ABC staff to explore possible ways to further quantify the ABC assessment process.

4. By far the most extensive application of our research efforts has been the initiation of two enrichment programs, developed in collaboration with MIT and offered during the summers of 1985 and 1986, to encourage high school students to enter the scientific fields. Emphasis was placed on recruiting and selecting excellent students for these programs with high potential in science, but who also may not have had the opportunity or encouragement to explore a scientific career. It was ABC's hope that introducing students to the factors defined by the Ford Foundation study as significant in influencing career choice at a point when academic preferences were still being shaped would encourage interest in the medical sciences.

Implementing a New Strategy

A Better Chance will continue these efforts and, it is hoped, expand them, as we search for even more successful ways to assure minority students the opportunity to select careers they will find satisfying, and which will allow them to make the fullest contributions to society of which they are capable. The research findings and experience of A Better Chance indicate that three areas need attention:

First, high school students need to be actively and consistently encouraged and enabled to take advanced mathematics and science courses.

Second, high school students need to be actively and consistently encouraged and enabled to see themselves as able to achieve in mathematics and science. Teacher encouragement and personal interest is critical in developing perceptions in these students that they are capable learners.

Third, the scientific aptitude of students of all ages needs to be assessed by means of criteria designed to broaden, rather than narrow, options which encourage interest in scientific careers.

The success of the ABC program indicates that steps toward these goals should be taken at the junior high school level, or even earlier, so that their full impact can be felt at the high school level. Students believing themselves able will tend to take more mathematics and science courses, and continued success in these will lead them to consider careers based on their abilities in several areas of endeavor.

The experiences of the ABC alumni implies that if students' abilities have been broadly and affirmatively developed, then a fair number of them will in fact elect to pursue science-oriented careers. All students interested and competent in science and mathematics will not choose careers in these areas, nor should they. However, they will have genuine options, and these options will be based on their strengths and not on their deficiencies or society's. And we will have taken several giant steps from where we are as a nation to all that we might become.

Notes

1. Garrison, H. (1986). Undergraduate science and engineering education for blacks and Native Americans. *Minorities: Their underrepresentation and career differentials in science and engineering*. Proceedings of a Workshop, National Research Council, p. 39.
2. Jones, F. and Minor, H. (n.d.). 1981 Summer study of black students graduating from MIT - 1973-1981.
3. Gordon, E. (1986, October). A Report to the Field: A descriptive analysis of programs and trends in engineering education for ethnic minority students.
4. Garrison, H. (1986). Special programs for minorities in science and engineering. *Minorities: Their underrepresentation and career differentials in science and engineering*. Proceedings of a Workshop, National Research Council, p. 56.
5. Turner, J. (1988, February 11). The talent pool for 1990 and beyond. Paper presented at MITRE Corp., Bedford, MA.
6. Johnson, S. and Prom-Jackson, S. (1983, December). Factors related to science and mathematics career choice in a minority population: A survey of alumni of A Better Chance, Inc. Final Report submitted to the Ford Foundation, Inc.
7. Ibid.
8. Johnson, S. and Prom-Jackson, S. (1987). Career choice in science-and mathematics-related areas among talented minority youth. Empirical Conference on Black Psychology, Lincoln University.
9. Johnson, S. and Prom-Jackson, S. (1983, December). Executive summary: Factors related to science and mathematics career choice in a minority population: A survey of alumni of A Better Chance, Inc. Final Report submitted to the Ford Foundation, Inc.
10. Ibid.
11. Ibid.

**Discussant Reaction:
The Minorities in Medicine Program**

Maxine E. Bleich

As part of a twenty year program to increase the number of minority students academically prepared for medical school, the Josiah Macy, Jr. Foundation for the past five years has supported programs that provide an academically rigorous course of study for specially selected minority students in grades 9 to 12. The projects were not exclusively extracurricular but, rather, were fundamental to the students' course of study.

Located in economically underprivileged settings, the high schools enroll disadvantaged students and have previously been unable to provide a strong academic program. Three programs are in New York City: at the A. Philip Randolph High School, in Harlem; at the DeWitt Clinton High School, in the Bronx; and at the Clara Barton High School for Health Professions, in Brooklyn. The other programs are at 30 small rural high schools in western Alabama, including some of the nation's poorest counties; at the Hillhouse High School, in New Haven, Connecticut; and at the Tuba City High School, in Arizona on the Navajo Reservation. The grants, awarded to institutions of higher education, are used to further collaboration between colleges, public schools, and local and state public-education authorities.

What Has Been Learned?

The ninth grade is not too late to introduce a rigorous academic program. Despite poor preparation, students can overcome deficiencies in mathematics and reading and can benefit from and enjoy an enriched course of study. Many minority eighth graders are motivated and eager to achieve. Most of their parents share their desire for achievement but are ignorant of what is required for academic success.

Almost uniformly, the teachers and administrators in the Macy-sponsored programs have been working in their school systems for twenty years. They have been pessimistic about their students' ability to achieve academically and cynical regarding their school systems' efforts to identify and educate minority talent. This pessimism and cynicism, which is partly related to egalitarian ideas that preclude individual or group achievement, have been reinforced for twenty years by the poor performance of the schools and youngsters.

These attitudes are not totally unfounded. Indeed, most of the Macy-sponsored youngsters do not start out as honors students, nor are their work habits strong enough to guarantee honors-levels work. But by the junior year the vast majority of them have not only maintained honors grades but have also achieved scores above the mean on nationally normed tests such as the SAT and ACT. These achievements and attitudes have had major effects on teachers' attitudes.

To date, more than 2,100 high school youngsters have enrolled in the Macy-sponsored projects, and it is anticipated that annually more than 4,500 students will eventually participate. If the present retention rate of 70 percent continues, more than 700 minority youngsters will graduate each year with an excellent high

school education. Further, if the existing levels of achievement are maintained, most of them will be honors students who score high on nationally normed tests.

It has taken two or three years for the projects to stabilize, for all parties to work together for meaningful achievements, and for the programs to be fully integrated into the schools. Teachers, administrators, and university faculty have forged productive working relationships that were long considered unattainable.

The Alabama project and two of the New York projects have completed five years. The graduating classes have been outstanding: each has included 70-80 percent of the original cohort of youngsters. Almost 100 percent of the graduates are going to selective four-year colleges, many of them with significant financial aid. More than 50 percent of the graduates intend to study medicine or a related health profession, or plan to obtain a degree in a biomedical science.

The Macy Foundation's program of documentation tracks the high school progress of the youngsters. In addition, they will be followed through their undergraduate years, to learn about their experiences and intentions to enroll in programs that prepare for careers in medicine, the related health professions, and the biomedical sciences.

Current Status of Minorities in Medicine

Despite the efforts of the past twenty years, medical school enrollments of minority students are down. Enrollment of blacks, for example, has declined from a high of 7.8 percent of the total medical student population in 1974-75 to less than 6 percent in 1983-84. Further, their rate of academic progress has slowed, and the percentage of black graduates has declined from 5.5 in 1977-78 to 4.8 in 1981-82.

Of the 2,644 blacks who applied to medical school in 1981, 984, or 37 percent, actually matriculated. In 1985 the number of applicants has fallen by more than 200, and 952 actually matriculated--representing a decline of 32 students. Despite the perception of minority applicants as academically better prepared in the 1980s than in the past, their academic progress has slowed. More than 16 percent have to repeat the first and second years, up from 14 percent in the 1970s; and the actual attrition rate has edged up to close to 11 percent from around 5 percent in the 1970s.

In 1984 Joan Baratz, Director of the Educational Policy Research and Services Division of the Educational Testing Service, surveyed minority students who took the MCAT, as well as enrolled minority medical students. She found that the number of black candidates to medical school was evenly divided between men and women, and that twice as many Hispanic males as females applied. The experience of the Macy-sponsored high school projects is quite different. In both the applicant pool and in enrollment, the students are overwhelmingly female.

Baratz also found that minority candidates for medical school were relatively middle-class, that 75 percent of them had taken an academic program in high school; that one-third had attended in which minority students constituted no more than 25 percent of the student population. These findings contrast radically with

the Macy-sponsored programs, which not only enroll youngsters from economically disadvantaged backgrounds but are located in minority high schools themselves.

Keeping in mind these characteristics of the applicant pool and of matriculating minority medical students, the following is a brief review of what is known about minorities in higher education. Again using blacks as an example: they represent 12 percent of the college-age population and 8 percent of the undergraduate enrollment. Because their persistence rates in college are lower than those for whites, they represent only 6.5 percent of undergraduate degree recipients.

Minority participation in science majors, which is important for admission to medical school or to other health-related programs, is similarly limited. Of the baccalaureate degrees conferred in biology in 1981, only 5.2 percent were awarded to blacks; they received only 3.8 percent of the physical science degrees and 3.3 percent of the engineering degrees.

After reviewing the literature, Baratz reports that the areas of weakest performance for minorities are in the biological and physical sciences and in mathematics. In particular, their apparent difficulty in problem-solving suggests, at least in part, that they have had limited opportunities to participate in academically rigorous science and mathematics courses before entering college. The Macy Foundation experience has highlighted their inadequate preparation in mathematics, science, and reading/English-language skills: many junior high school students do not spend even one hour a week of class time on mathematics and science.

According to Baratz's survey, 77 percent of the black and 73 percent of the Hispanic students had decided on medicine as a career by the time they completed high school. Interestingly, however, few of them had participated in special educational activities that might promote their success. Although nearly 40 percent had volunteered for health-related activities, less than 10 percent reported that they had received tutoring in science and mathematics in high school. Less than 12 percent had received formal preparation for the SAT, which has a significant correlation with the MCAT. Only 20 percent reported receiving guidance about college applications. These data are of particular interest, since most of the students surveyed by Baratz had graduated from advantaged high school settings.

The following are brief summaries of the Macy-sponsored high school programs.

Alabama--Biomedical Sciences Preparation Program (BIOPREP)

The University of Alabama College of Community Health Sciences in Tuscaloosa, a clinical campus of the university's medical school, was established to increase the number of health professionals practicing in rural Alabama. In an effort to develop rural talent, BioPrep was designed to work in five rural high schools in three of the state's poorest counties, where more than half of the families live below the federally designated poverty level. The median school years

completed is less than 8.5, and prior to BioPrep the school systems had been unable to identify "gifted and talented" youngsters using federal criteria.

During the program's first four years, more than 100 youngsters were enrolled in a rigorous academic program emphasizing science, mathematics, and language skills. Tutorials, enriched science laboratories, and independent study were offered at the schools; bimonthly Saturday sessions and six-week summer programs were held at the University of Alabama. Curriculum development was a collaborative venture between the high school teachers, BioPrep staff, and selected university faculty. Extensive in-service training was provided, and an evaluation was completed, using schools in neighboring counties as controls.

After four years, much has been accomplished. Of the originally selected 114 students, 79 percent were retained in the honors program--and all 114 went on to college. Macy graduates have received multiple acceptances from selective schools, and many have received scholarships. More than half expect to pursue careers in medicine and the related health professions. All the Macy graduates took the mathematics placement exam given to incoming University of Alabama freshmen: 88 percent of them placed into calculus or pre-calculus. By contrast, less than 10 percent of the 2,600 Alabama freshmen do as well. These are crowning achievements for schools that have traditionally sent few graduates to college.

When BioPrep was established, there were serious doubts about the schools' abilities to identify a "critical mass" of youngsters with the potential and motivation to enroll in rigorous academic studies. These doubts have proved to be unfounded. Several schools have enrolled new classes in each year of the program, and in each setting there is a growing interest in, and demand for, an even more rigorous curriculum.

Other areas of initial concern were the teachers' abilities and willingness to try new materials and teaching methods, but for the most part, the teachers have been enthusiastic participants. Indeed, their achievement have intrigued and motivated other teachers and school systems. BioPrep now includes 30 schools in western Alabama, most of them financially poor, serving primarily an economically disadvantaged black population. Each school has established and supports an honors program for approximately 20 youngsters each year. Thus, when the programs are in full swing, each will enroll 80 BioPrep students in grades 9 to 12.

The New York City Program: A. Philip Randolph High School, Manhattan; DeWitt Clinton High School, Bronx; Clara Barton High School for Health Professions, Brooklyn

The New York City projects are a joint venture with the New York City Board of Education and three colleges that constitute the City University of New York: Brooklyn, City and Lehman Colleges. Macy Foundation support provides enriched science and mathematics laboratories, research projects, tutoring, cultural enrichment, staff development, and summer programs for tenth and eleventh graders. The Board of Education supports reduced class size, additional instructional periods, additional guidance and counseling services, a school psychologist, supervisory personnel, and summer programs for entering ninth

graders. The projects have also served as a model for a statewide grant program designed to prepare minority students for the licensed professions, with special emphasis on medicine and the related health professions.

With Foundation assistance, a residential summer program for rising eleventh and twelfth graders, entitled CAMPSTAR, was established last year (Commitment, Achievement, Motivation, Progress through Stress on Thinking, Analyzing and Reasoning Skills). Additional support to continue the program has been obtained from grants programs administered by the New York State Department of Education. CAMPSTAR is designed to develop and strengthen analytical reasoning skills. Laboratories in applied mathematics, biology, and chemistry are coordinated to demonstrate how selected principles and problem-solving strategies can be used across the disciplines. Vocabulary, reading, and oral expression also are emphasized.

Hillhouse High School, New Haven, Connecticut

The Hillhouse project, jointly funded with the Herzog Foundation, is part of a statewide School Improvement Program based partly on techniques developed by the Yale Child Study Center. After an initial year of planning, the ninth and tenth year programs are now in place.

Working with a specially structured Steering Committee comprising administrators, teachers, parents, children, Yale Child Study Center staff, and representatives of the Connecticut State Department of Education, the faculty of Hillhouse has determined the students' educational and social needs.

This program differs from the other Macy-sponsored programs in that the Macy students are not grouped together for their four years of high school, but, rather, are grouped by reading and mathematics levels. Thus, Macy and non-Macy youngsters take the same classes. However, the Macy students have a required curriculum and are brought together for a variety of specially designed enrichment activities. It is anticipated that the Macy youngsters will be enrolled in the same courses at the beginning of their junior year.

The school day has been extended for the Macy/Herzog students, enabling them to receive tutoring and to prepare for standardized tests. They also participate in academic enrichment activities designed to inform them about career opportunities in the health professions, as well as the academic preparation necessary to pursue such careers. Moreover, tenth grade students are assigned teacher-mentors, with whom they maintain a continuing advisory and counseling relationship throughout their high school years.

Tuba City High School, Tuba City, Arizona

After a year of planning, the ninth and tenth grade programs have now been implemented. The project was initially conceived as an advanced science and mathematics program, with emphasis on the physical sciences. However, the concept proved to be too abstract and lacked an organizing theme for the students and teachers. To give the program a focus, the theme has changed to approximate

the other Macy-sponsored projects; and BioPrep, the name of the Alabama program, has been borrowed.

A program in physics and applied mathematics was designed for the ninth grade, and a special biological chemistry course has been developed for the tenth. Counseling, tutoring, and special summer programs are included, and funds have been made available for educational trips off the Navajo Reservation.

For most of the first year, only about 25 percent of the 110 project students were performing well. Part of the academic problem was due to inadequate preparation for high school, poor motivation, and limited facility with the English language. However, much to everyone's surprise--not least the students'--most of them have done well on standardized exams given at the close of the school years. Students who had tested below grade in many subjects in September scored at levels from one to four years above their grade in June.

Summary

These brief program descriptions are meant to suggest the kinds of relationships that can and must be established among public schools, colleges, and professional schools. The nation provides tax-levy dollars for the education of its children; it is essential to help the schools establish academic standards and to develop programs that enable students to meet them. The activities are labor-intensive and require atypical institutional relationships. The need is great, but the demonstrated achievements of the youngsters are even greater: they are little short of startling!

Discussant Reaction:
Better Measures: Developing More Minority
Mathematicians and Scientists

Belvin Williams

I thought I would divide my remarks into just a few parts. One, I'm going to do what I was asked to do by the conference organizers and respond to Judith Griffin's presentation. Two, I thought that I'd raise some other questions, one or two of which might be directed to Ms. Griffin, and others which might be directed to all of us who are interested in the more general problem of trying to increase minority talent for the sciences. So I'll start by first addressing some comments to Ms. Griffin's remarks.

I'll begin talking about the way I perceive the logic of the problem of the underrepresentation of minorities in science and math. There are two parts: 1) the logic of the selection problem, and I think ABC is in the middle of that; and the larger problem 2) the logic of increasing the minority pool.

One of the things I thought I would explain is that ABC is trying to find a set of predictors or selectors which will enable them to identify children who are likely to be successful in boarding schools and independent schools. I think that what they do is quite admirable. I've spent some time in the ABC office watching the staff go through the files, reading the cases, and having the discussions about the kids. As Ms. Griffin says there's a great deal of care and attention given that. Properly, I think, they are cautious about the use of the SSAT and since Ms. Griffin has spent a great deal of time on that instrument I thought I should comment about it. I must admit I do this with a certain amount of embarrassment for several reasons. One, since I was senior vice-president for all the testing programs at ETS, one of my small responsibilities was the SSAT. The SSAT has no relationship to the SAT, which is a test published by the College Board. I thought in preparing for this paper that I would go back and look at some of the data on the SSAT to refresh my memory. I called the program director at ETS and asked about the validity studies for the test, and where I could find the test. I consulted the *Buros Mental Measurements Yearbook*, which every good psychologist uses, and I could find no reference to the SSAT. There were no public reviews of that test in the *Ninth Mental Measurement Yearbook*. I also looked at *Tests in Print* and I could still find no reference to the SSAT. I looked through the ETS catalog of test collections, and I couldn't find the SSAT there either. So I called the program director at ETS, and I said, "Why isn't this test listed in any of these places that you're supposed to look for reviews?" and there was no answer to that.

In general, the test doesn't enjoy the wide support of validity studies that the SAT does. And I think that the ABC staff is well advised to use it with caution. I also think the Secondary Schools Admission Council should do something about finding out what the SSAT measures. It clearly has very little evidence to recommend it as a differential predictor, and certainly I think it's wise to take that into account, and whatever subjective weighting the ABC staff uses.

I would like to relate one of the problems that any of these tests have to something that was discussed about the SSAT. When the SSAT was first created, there was a question about the meaning of high and low scores. There was a fair amount of confidence about the meaning of a high score, that is, that there was mastery of certain kinds of skills that were certainly useful in taking a test in

academic work. Even more, it was related to levels of success in the first year of college as measured by grades. But the meaning of a low score was not clear. A low score did not mean no aptitude, because that's not the nature of the scale. It's not like a ruler, not like a measure of weight where you say there is weight or there is no weight, because of the scaling of the instrument. So when the scores are low on the SSAT, ABC tends to disregard them, and they look very carefully at other indicators. That practice has been of major interest as we try to broaden the number of indicators that can be used to identify talent.

Let me dwell a little longer on the logic of this problem. We have three variables which contribute to the situation at ABC: 1) trying to find a predictor or predictors; 2) looking at the criteria that are going to be predictive, and I want to talk about that; and 3) the relationship between the two.

In much of our thinking about the identification of talent, a great deal of attention is paid to the selection device: an overemphasis is placed on it, I would even say. We have discussed at the Talent Identification Program advisory board meetings whether too much emphasis has not been placed on the SAT or the ACT to select and identify talent. It is quite clear that the SAT or the SSAT do not identify all of the cognitive skills that are necessary for college success. So first, you have an initial restriction of test content. Second, even if you had at least samples from all of those domains that were relevant to college success, there is always measurement error. That's just the nature of empirical inquiry. The SAT, luckily, only has a measurement error of plus or minus about 30 points. However, the measurement error for the SSAT is probably a little larger, because I'm not sure that the reliability figure is as great for the SSAT as for the SAT. Third, the criterion always has measurement error, regardless of the criterion. Now at ABC they use another indicator of academic performance, academic grades. In some cases schools recompile the index of a GPA. I suspect that's not a bad thing to do, but when you try to correlate some kind of test indicator to school performance by using first year grades or second year grades, you have to account for the elements in a grade point average that add to the error problem.

Even if you had a perfect criterion and a perfect predictor there is always the problem of the statistical function that relates the two. Typically that's created via a linear relationship like correlation or regression, and there is error in that. And the kind of variable that Ms. Griffin was talking about--persistence, tenacity, the ability not to become discouraged when the going gets tough--no one really knows whether these have a straight linear relationship to measures of success. They may have other kinds of relationships. I'm sure that in some instances there may still other variables involved, for example a "humility factor" represents gratitude of a student for the efforts made by others. How you get a fix on the effects of these variables is not clear. I'm not persuaded that all of these variables either need to be quantified or can be quantified. I do think, obviously, quantification has its advantages; at least you can state things more precisely and then go back, we hope, and try to find the location, source and size of the error. Aside from that, not everything in life has to be quantified. So, there are three parts of this relationship, the predictor, the criteria set, and the relationship between these two that is complicated.

The ABC staff spends considerable time looking at what goes on in the schools. That's atypical for the prediction situation. Typically, to get into college you take the ACT or SAT, or the GRE if you're going to graduate school. Students don't know if the situation at Duke is the same as Harvard or Columbia or the University of Kansas; there all kinds of different things at work.

But at ABC the staff are at an advantage in that they spend time with the headmasters, headmistresses, the admissions staff. They visit the college to determine if their kid will or will not fare well in that environment. It's one thing to say that Phillips Academy at Andover is a great school, but that part of Massachusetts is cold and isolated, and Exeter may be even worse. At ABC they do an excellent job of trying to match some of the dispositions of the kids with what they know about the school. That's a special charm about ABC, and it's a task that I'm not sure can even be performed well by the admissions office of the particular school. I don't think that admissions offices staffs gain a distance from their institution. Most of them come trying to find the best students for their schools. They have a job to do. ABC on the other hand, clearly has a mission to help the schools find talent, but at the same time they have to act as advocates for the kids. This particular role of acting as advocates is very important for minority kids, especially black kids and Hispanic kids in particular in the United States, because there has been a history of discrimination against minorities in most if not all of these institutions. That's just one of those facts one has to try to overcome and not pretend that it is not an historical fact. Nor can we pretend that all of the relevant variance for success in college can be picked up by the standardized tests.

I wanted to comment on the issue of increasing the minority pool in science, technology, and math. It's clear from what Ms. Griffin described that there's a residual, there's a set of kids that don't get into college. There's a set of kids that don't get in the TIP program, as far as that's concerned. There's always, as I said, measurement error. There's a set of false negatives, if I can put it that way. If we really wanted to increase the pool, it might be advisable to see if we could adopt some of the kinds of strategies--if it could be done in a cost efficient way--that ABC has been using to identify kids they place in boarding schools and independent schools around the country. It appears to me on the basis of sheer numbers that there are lots of minority kids out there. If you look at the U.S. census data, I don't think that one could argue very strongly that there aren't very many minority kids. Even if you took only one per cent of the age cohorts, from 14-17, 18-24, one per cent would be a huge number of black kids alone, to say nothing of Hispanic kids and others who are in this group, who could be identified for higher educational experiences, and with considerable success. How one broadens the pool of talent is a very difficult problem, because of the finances involved, and so on, but this is what we're here to try to discuss.

I wanted to end some of my comments with some interesting things, especially with regard to social context. Social context is very critical, and I'll just touch briefly on some experiences that we have had with the Macy high school programs. The importance of the students perceiving--as well as the teachers perceiving--that they can succeed in mathematics and science cannot be undervalued. I don't think that it can be underestimated how important it is that the student feels that the adults who are in responsible positions believe that they can succeed, and believe

that they are going to get support for their efforts. Mathematics itself is not very complicated. Taking the SAT is not very complicated. Those are straightforward kinds of problems. There are a lot of other variables that tend to get in the way of these students, and there is not that kind of support structure as in the case of ABC as an organization.

In the case of the Macy programs, one of the things that we have discovered is that you had to convince the teachers and the principals that the kids could do it. You had to say, "Hey, I look at your kids, and I notice that they're getting a combined score on Verbal and Mathematics parts of the tests of 900. I have no reason to believe that they couldn't get 1200. So, why don't you work on their verbal skills, why don't you work on their math, why don't you help them understand certain things. Give them more reading assignments." And you know, we've been documenting the progress of the students year by year, and those scores go up. They do get 1200 on the SAT, in point of empirical fact.

The teachers and some of the principals turn around and say, "My God, they are able to do it," and there's a certain kind of pride in all of this. So the social context in which the child finds him/herself is very important. And I must say we have observed kids in New York, the Bronx, Brooklyn, and Manhattan, who come from very trying circumstances, who are able to achieve. That achievement is, I think, a real feather in their caps, and to all the people who have assisted them.

I want to suggest that in the interest of increasing the number of scientists and mathematicians there is also a need to increase minority psychometricians. When you think about the history of educational measurement in the United States there have not been too many minorities who have been significant in this dialogue. There should be because of the issues which surround what variables you look at and how you look at them. And it has to be done with rigor. There's nothing that should be sloppy, or soft about this. But it has to be done with rigor over a long time, and I think one way to do that is getting people who are interested in understanding some of the other factors that enable varieties of children from different ethnic groups, black, Hispanic, Native Americans, to survive and achieve. I think that unless there are minority researchers doing it, that it probably won't be done. I suspect it's no different than the situation with women in education. Unless there are women who are concerned about understanding why women achieve or do not achieve, it won't be done. So the research needs to be done by people who have a stake in the results; there's nothing wrong with having a stake in things. It's a very constructive bias.

Finally, I'll address a question having to do with the situation of the public school program where the students are living with "host families". I wonder whether there's been any thought given to the advantages of having the students live with these families, especially in places like Richfield, or Stamford, Connecticut. I have a great feeling for Massachusetts and parts of New England, as you know, but there are parts of Connecticut that always remind me of the "man in the grey flannel suit." Parts of Connecticut change very slowly. No matter how long you live there or in Massachusetts, you're never one of them because your parents didn't come over on the Mayflower. In any event, I think that it's an interesting question. Some of Ron Edmonds's research found that the families become advocates for the kids. Both Ms. Griffith and I know that some

of the families have been significant in this program. Some of them I've known, IBM executives in particular, take this very seriously and they work very hard to do what is right.